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TITLE:

Quantification and communication of Carbon FootPRINT and GHG emission reductions/avoided emissions from electric and electronic products and systems – Principles, methodologies, requirements and guidance

NOTE FROM TC/SC OFFICERS:

This A version replaces the previous document where the attached draft was incorrect. The closing date remains the same.

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**QUANTIFICATION AND COMMUNICATION OF CARBON FOOTPRINT AND
GHG EMISSION REDUCTIONS/AVOIDED EMISSIONS FROM ELECTRIC
AND ELECTRONIC PRODUCTS AND SYSTEMS – PRINCIPLES,
METHODOLOGIES, REQUIREMENTS AND GUIDANCE**

FOREWORD

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International Standard IEC 63372 has been prepared by IEC technical committee 111: Environmental standardization for electrical and electronic products and systems.

The text of this International Standard is based on the following documents:

Draft	Report on voting
XX/XX/FDIS	XX/XX/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English].

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at <http://www.iec.ch/standardsdev/publications>.

150 The committee has decided that the contents of this document will remain unchanged until the
151 stability date indicated on the IEC website under webstore.iec.ch in the data related to the
152 specific document. At this date, the document will be

- 153 • reconfirmed,
- 154 • withdrawn,
- 155 • replaced by a revised edition, or
- 156 • amended.

INTRODUCTION

Based on IPCC reports regarding global warming, there is broad understanding that greenhouse gas (GHG) emissions must be significantly reduced in the coming 10 or more years. Products and systems including ones called as solution composed of electric and electronic (EE) products, operated and controlled by new digital technologies and methods such as AI, digital twins and IoT can significantly change patterns of energy usage for energy intensive activities, although having by themselves an environmental impact.

Such a change of the pattern of energy usage by adding a digital technology has the potential to avoid GHG emissions represented by CO₂ emission for energy intensive activities. Although the EE products themselves lead to GHG emissions, the GHG emission of the complete activity is significantly lowered, so that the net effect is a reduction of GHG emissions.

The necessity of a sector specific approach applicable to EE products and systems is recognized by considering the specific characteristics of EE products which could include a large quantity of components/materials in a product, dynamic, long, and complicated supply chains, rapidly evolving technology, the complexity of production processes, and use/end-of-life scenarios, etc., which can lead to considerable challenges in performing CFP, emission reductions and avoided emissions.

Furthermore, manufacturers of products, systems composed of electric and electronic (EE) products need robust and reliable calculation methods to establish the amount of avoided emissions caused by their products, systems and solutions. One of important purpose for this standard is to define methodologies which assess avoided emissions from the use of new technologies in an unambiguous and transparent manner.

Use of this GHG standard allows the EE industry to declare or disclose the information about GHG emissions, emission reductions and avoided emissions from any EE products, systems on the basis of an international standard, linking social needs for GHG emission reductions. Through the information disclosure based on this IEC standard, EE industry can claim fairly that the products, services and systems can reduce/avoid users' emissions and contribute to solving societal issues directly linked with UN-SDG13 Climate Action.

This document refers to established methodologies stipulated by international standards such as Life Cycle Assessment (LCA) methods covered by existing product specific rules (PSR) when defined or to product category rules (PCR) when defined. See IEC 63336 CDV (Current status) for EE products or ITU 1410 for ICT products and services or to ISO 14040 for any other products and services.

The PCRs and PSRs address the climate change impact category within GHG emissions quantification. The methodologies in this document are based on ISO 14064 series and ISO 14067 which might be completed by GHG protocol methodologies if any.

QUANTIFICATION AND COMMUNICATION OF CARBON FOOTPRINT AND GHG EMISSION REDUCTIONS/AVOIDED EMISSIONS FROM ELECTRIC AND ELECTRONIC PRODUCTS AND SYSTEMS – PRINCIPLES, METHODOLOGIES, REQUIREMENTS AND GUIDANCE

1 Scope

This document describes principles and methodologies, specifies requirements and provides guidance for GHG quantification and communication of Carbon footprint, emission reductions and avoided emissions from Electric and Electronic (EE) products and systems.

This document is applicable to EE products, systems and EE product-related GHG project.

This document has the status of a horizontal publication in accordance with IEC Guide 108.

This document does not address carbon neutrality.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 63366, Product category rules for life cycle assessment of electrical and electronic products and systems (*CDV stage*)

ISO14067:2018, Greenhouse gases — Carbon footprint of products — Requirements and guidelines for quantification

3 Terms, definitions, and abbreviated terms

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

IEC Electropedia: available at <http://www.electropedia.org/>

ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1 Terms related to greenhouse gas

3.1.1 carbon dioxide equivalent CO₂ equivalent CO_{2e}

unit for comparing the radiative forcing of a GHG to that of carbon dioxide

Note 1 to entry: Mass of a GHG is converted into CO₂ equivalents by multiplying the mass of the GHG by the corresponding GWP or GTP of that gas.

228 Note 2 to entry: In the case of GTP, CO₂ equivalent is the unit for comparing the change in global mean surface
229 temperature caused by a GHG to the temperature change caused by CO₂.

230 [SOURCE: ISO 14067:2018, 3.1.2.2]

231 **3.1.2**
232 **global warming potential**
233 **GWP**

234 index, based on radiative properties of GHGs, measuring the radiative forcing following a pulse
235 emission of a unit mass of a given GHG in the present-day atmosphere integrated over a chosen
236 time horizon, relative to that of carbon dioxide (CO₂)

237 Note 1 to entry: “Index” as used in this document is a “characterization factor” as defined in ISO 14040:2006, 3.37.

238 Note 2 to entry: A “pulse emission” is an emission at one point in time.

239 Note 3 to entry: Always following “global warming potential values relative CO₂ for greenhouse gas” IPCC latest
240 assessment report.

241 [SOURCE: ISO14067:2018, 3.1.2.4, modified removed “(3.1.2.1)” and added Note 3 to entry]

242 **3.1.3**
243 **greenhouse gas**
244 **GHG**

245 gaseous constituent of the atmosphere, both natural and anthropogenic, that absorbs and emits
246 radiation at specific wavelengths within the spectrum of infrared radiation emitted by the earth’s
247 surface, the atmosphere, and clouds

248 Note 1 to entry: For a list of GHGs, see the latest IPCC Assessment Report.

249 Note 2 to entry: Water vapour and ozone, which are anthropogenic as well as natural GHGs, are not included in the
250 CFP and partial CFP.

251 Note 3 to entry: The focus of this document is limited to long-lived GHGs, it therefore excludes climate effects due
252 to changes in surface reflectivity (albedo) and short-lived radiative forcing agents (e.g., black carbon and aerosols).

253 [SOURCE: ISO 14067:2018, 3.1.2.1]

254 **3.1.4**
255 **greenhouse gas emission**
256 **GHG emission**

257 release of a GHG into the atmosphere

258 [SOURCE: ISO 14067:2018, 3.1.2.5]

259 **3.1.5**
260 **greenhouse gas emission factor**
261 **GHG emission factor**

262 coefficient relating activity data with the GHG emission

263 [SOURCE: ISO 14067: 2018, 3.1.2.7]

264 **3.1.6**
265 **greenhouse gas removal**
266 **GHG removal**

267 withdrawal of a GHG from the atmosphere

268 Note to entry: Examples of ways in which GHG removals can be achieved include carbon sequestration in soils,
269 direct air capture, carbon capture and storage.

270 [SOURCE: ISO 14067:2018, 3.1.2.6]

271 **3.2 Terms related to the GHG quantification process**

272 **3.2.1 Quantification of Carbon footprint (GHG emissions and GHG removals)**

273 **3.2.1.1** 274 **allocation**

275 partitioning the input or output flows of a process or a product system, correlating the product
276 system under study with one or more other product systems

277 [SOURCE: IEC TR 62725:2013, 3.1]

278 **3.2.1.2** 279 **Carbon emission intensity** 280 **CO₂ emission intensity** 281 **Carbon intensity**

282 Carbon metric expressed in relation to a specific reference unit related to the function of the
283 activity or to a location

284 Note to entry: carbon intensity of energy use can be electricity generation (renewable energy production such as
285 photovoltaic, wind turbine) or consumption (electrical loads)

286 **3.2.1.3** 287 **carbon footprint of a product** 288 **CFP**

289 sum of GHG emissions and GHG removals in a product system, expressed as CO₂ equivalents
290 and based on a life cycle assessment using the single impact category of climate change

291 Note 1 to entry: A CFP can be disaggregated into a set of figures identifying specific GHG emissions and GHG
292 removals (see Table 1). A CFP can also be disaggregated into the stages of the life cycle.

293 Note 2 to entry: The results of the quantification of the CFP are documented in the CFP study report expressed in
294 mass of CO₂e per functional unit.

295 [SOURCE: ISO 14067:2018, 3.1.1.1]

296 **3.2.1.4** 297 **carbon footprint of a product – product category rules** 298 **CFP-PCR**

299 set of specific rules, requirements and guidelines for CFP or partial CFP quantification and
300 communication for one or more product categories

301 Note 1 to entry: CFP-PCR include quantification rules conforming to ISO 14044.

302 Note 2 to entry: ISO/TS 14027 describes the development of PCR applicable to this document.

303 [SOURCE: ISO 14067:2018, 3.1.1.10]

304 **3.2.1.5** 305 **carbon footprint of a product study** 306 **CFP study**

all activities that are necessary to quantify and report a CFP or a partial CFP

[SOURCE: ISO 14067:2018, 3.1.1.4]

3.2.1.6
carbon footprint of a product study report
CFP study report

report that documents the CFP study, presents the CFP or partial CFP, and shows the decisions taken within the study

Note to entry: The CFP study report demonstrates that the provisions of this document are met.

[SOURCE: ISO14067:2018, 3.1.1.5]

3.2.1.7
declared unit

quantity of a product for use as a reference unit in the quantification of a partial CFP

EXAMPLE Mass (1 kg of primary steel), volume (1 m³ of crude oil).

[SOURCE: ISO 14067, 3.1.3.8]

3.2.1.8
direct greenhouse gas emission
direct GHG emission

greenhouse gas emission from greenhouse gas sources owned or controlled by an organization

[SOURCE: ISO 14050:2020, 3.9.9]

3.2.1.9
energy indirect greenhouse gas emission
energy indirect GHG emission

greenhouse gas emission from the generation of imported electricity, heat, or steam consumed by an organization

[SOURCE: ISO 14050:2020, 3.9.11]

3.2.1.10
functional unit

quantified performance of a product system for use as a reference unit

Note 1 to entry: As the CFP treats information on a product basis, an additional calculation based on a declared unit can be presented.

[SOURCE: ISO 14067:2018, 3.1.3.7]

3.2.1.11
other indirect greenhouse gas emission
other indirect GHG emission

greenhouse gas emission, other than energy indirect GHG emissions, that is a consequence of an organization's activities, but arises from greenhouse gas sources that are owned or controlled by other organizations.

344 [SOURCE: ISO 14050:2020, 3.9.12]

345 **3.2.1.12**
346 **partial carbon footprint of a product**
347 **partial CFP**

348 sum of GHG emissions and GHG removals of one or more selected process(es) in a product
349 system, expressed as CO₂ equivalents and based on the selected stages or processes within
350 the life cycle

351 Note 1 to entry: A partial CFP is based on or compiled from data related to (a) specific process(es) or footprint
352 information modules, which is (are) part of a product system and can form the basis for quantification of a CFP. More
353 detailed information on information modules is given in ISO 14025:2006, 5.4.

354 Note 2 to entry: "Footprint information modules" is defined in ISO 14026:2017, 3.1.4. Note 3 to entry: The results of
355 the quantification of the partial CFP are documented in the CFP study report expressed in mass of CO₂e per declared
356 unit.

357 [SOURCE: ISO 14067:2018, 3.1.1.2]

358 **3.2.1.13**
359 **primary data**

360 quantified value of a process or an activity obtained from a direct measurement or a calculation
361 based on direct measurements

362 Note 1 to entry: Primary data need not necessarily originate from the product system under study because primary
363 data might relate to a different but comparable product system to that being studied.

364 Note 2 to entry: Primary data can include GHG emission factors and/or GHG activity data (defined in ISO 14064-
365 1:2006, 2.11).

366 [SOURCE: ISO 14067:2018, 3.1.6.1]

367 **3.2.1.14**
368 **process**

369 set of interrelated or interacting activities that transforms inputs into outputs

370 [SOURCE: ISO 14067:2018, 3.1.3.5]

371 **3.2.1.15**
372 **product**

373 goods or service

374 Note 1 to entry: The product can be categorized as follows:

375 — service (e.g., transport, implementation of events);

376 — software (e.g., computer program);

377 — hardware (e.g., engine mechanical part);

378 — processed material (e.g., lubricant, ore, fuel);

379 — unprocessed material (e.g., agricultural product).

380 Note 2 to entry: Services have tangible and intangible elements. Provision of a service can involve, for example, the
381 following:

382 — an activity performed on a customer-supplied tangible product (e.g., automobile to be repaired);

383 — an activity performed on a customer-supplied intangible product (e.g., the income statement needed to prepare a
384 tax return);

385 — the delivery of an intangible product (e.g., the delivery of information in the context of knowledge transmission);

386 — the creation of ambience for the customer (e.g., in hotels and restaurants).

387 [SOURCE: ISO 14067:2018, 3.1.3.1]

388 **3.2.1.16**
389 **product category**

390 group of products that can fulfil equivalent functions

391 Note to entry: “Product category” is defined by a set of product families,

392 [SOURCE: ISO 14067:2018, 3.1.1.8, modified add note to entry]

393 **3.2.1.17**
394 **product category rules**
395 **PCR**

396 set of specific rules, requirements, and guidelines for developing Type III environmental
397 declarations and footprint communications for one or more product categories

398 Note 1 to entry: PCR include quantification rules conforming to ISO 14044.

399 Note 2 to entry: ISO/TS 14027 describes the development of PCR applicable to this document.

400 Note 3 to entry: “Footprint communication” is defined in ISO 14026:2017, 3.1.1.

401 [SOURCE: ISO 14067:2018, 3.1.1.9]

402 **3.2.1.18**
403 **product family**

404 set of products or services sharing explicitly defined and managed common and variable features
405 and relying on the same domain architecture to meet the common and variable needs of specific
406 markets [ISO/IEC 26550:2015 Software and systems engineering — Reference model for product
407 line engineering and management, 3.16]

408 Note to entry: “Product families” are defined by product standards and could need product specific rules (PSRs),
409 “product range” are defined by manufacturers.

410 [SOURCE: ISO/IEC/IEEE 24765:2017, 3.3100. modified, add note to entry]

411 **3.2.1.19**
412 **product specific rules**
413 **PSR**

414 set of specific rules, requirements and guidelines, based upon and complementing the PCR,
415 for a specific product family

416 Note to entry: PCR and PSR are comparative concepts. To ensure consistency in IEC community, PCR refer to
417 rules at EE products and systems level, and PSR refer to rules at product committee level.

418 [SOURCE: IEC CDV 63366:202X, 3.32]

419 **3.2.1.20**
420 **product system**

421 collection of unit processes with elementary flows and product flows, performing one or more
422 defined functions and which models the life cycle of a product

423 Note to entry: “Product flow” is defined in ISO 14040:2006, 3.27.

424 [SOURCE: ISO 14067:2018, 3.1.3.2]

425 **3.2.1.21**
426 **reference service life**
427 **RSL**

428 representative time period where a product in use meets or exceeds the performance
429 requirements

430 [SOURCE: ISO 14067:2018, 3.1.3.11 modified added “reference” and “representative”]

431 **3.2.1.22**
432 **secondary data**

433 data which do not fulfil the requirements for primary data

434 Note 1 to entry: Secondary data can include data from databases and published literature, default emission factors
435 from national inventories, calculated data, estimates or other representative data, validated by competent
436 authorities.

437 Note 2 to entry: Secondary data can include data obtained from proxy processes or estimates.

438 [SOURCE: ISO14067:2018, 3.1.6.3]

439 **3.2.1.23**
440 **system boundary**

441 boundary based on a set of criteria representing which unit processes are a part of the system
442 under study

443 Note 1 to entry: The system boundary is closely related to the product system and cut-off. The system boundary defines the
444 wider system (e.g., the Internet) in which the studied product system (e.g., a specific radio access network) exist. The cut-off is
445 made from the studied product system.

446 Note 2 to entry: The system boundary enables identifying operational boundary, so respective emissions associated with its
447 operations, categorizing them as direct GHG emissions and indirect GHG emissions.

448 [SOURCE: ISO 14067:2018, 3.1.3.4, modified deleted “(3.1.3.6)” and added Note 1 to entry
449 and Note 2 to entry]

450 **3.2.1.24**
451 **uncertainty**

452 parameter associated with the result of quantification that characterizes the dispersion of the
453 values that could be reasonably attributed to the quantified amount

454 Note 1 to entry: Uncertainty can include, for example:

- 455 — parameter uncertainty, e.g. GHG emission factors, activity data;
- 456 — scenario uncertainty, e.g. use stage scenario, end-of-life stage scenario;
- 457 — model uncertainty.

458 Note 2 to entry: Uncertainty information typically specifies quantitative estimates of the likely dispersion of values
459 and a qualitative description of the likely causes of the dispersion.

[SOURCE: ISO14067:2018, 3.1.6.4]

3.2.2 Quantification of GHG emission reductions and avoided emissions

3.2.2.1

assessed product

a product assessed in a study of GHG emission reductions or avoided emissions

[SOURCE: IEC TR 62726:2014, 3.1, modified added “is assessed” and “in a study of GHG emissions reductions or avoided emissions” and deleted “have been evaluated” and “within a related GHG project”]

3.2.2.2

avoided emissions

greenhouse gas emission reduction that occurs outside the organization boundaries of the reporting organization as a quantifiable consequence to a situation of the use of its product, system or project compared to a baseline scenario

Note to entry: Avoided emissions cover the user value of GHG emissions reductions compared to a reference situation. It does not cover the GHG emission reductions related to direct GHG emissions, energy indirect GHG emissions and other indirect GHG emissions.

[SOURCE: ISO 14050:2020 3.9.16 modified added “a quantifiable”, “to a situation”, “system, or project or project compared to a baseline scenario” and “Note to entry”, and delete “a direct”]

3.2.2.3

baseline scenario

estimated reference situation that best represents the conditions most likely to occur in the absence of a target product or assessed product, system or project

[SOURCE: IEC TR 62726:2014, 3.2 modified deleted “hypothetical” and added “estimated” and deleted “proposed greenhouse gas project” and added “target product or assessed product, system or project”]

3.2.2.4

EE product-related greenhouse gas project

EE product related GHG project

activity or activities performed as a result of the development and supply of electrical and electronic products into the market that alter the conditions identified in the baseline scenario which cause greenhouse gas emissions reduction

[SOURCE: IEC TR 62726:2014, 3.4 modified deleted “note to entry”]

3.2.2.5

greenhouse gas emission reduction

GHG emission reduction

calculated decrease of GHG emissions between a baseline scenario and a target situation, or between a reference product, system or project and target product, system or project

[SOURCE: IEC TR 62726:2014, 3.10 modified added “a target situation”, “or between a reference product, system or project and the target product or assessed product, system, or”]

3.2.2.6

greenhouse gas reservoir GHG reservoir

physical unit or component of the biosphere, geosphere, or hydrosphere with the capability to store or accumulate a GHG removed from the atmosphere by a greenhouse gas sink or a GHG captured from a greenhouse gas source

Note 1 to entry: The total mass of carbon contained in a GHG reservoir at a specified point in time could be referred to as the carbon stock of the reservoir.

Note 2 to entry: A GHG reservoir can transfer greenhouse gases to another GHG reservoir.

Note 3 to entry: The collection of a GHG from a GHG source before it enters the atmosphere and storage of the collected GHG in a GHG reservoir could be referred to as GHG capture and storage.

[SOURCE: IEC TR 62726:2014, 3.13]

3.2.2.7

greenhouse gas sink GHG sink

physical unit or process that removes a GHG from the atmosphere

Note 1 to entry: An example is the process of collection, storage, and possible destruction of residual refrigerant at the end-of-life stage

[SOURCE: IEC TR 62726:2014, 3.14]

3.2.2.8

greenhouse gas source GHG source

physical unit or process that releases a GHG into the atmosphere

[SOURCE: IEC TR 62726:2014, 3.15]

3.2.2.9

materiality

concept that individual or the aggregation of errors, omissions and misrepresentations could affect the GHG assertion and could influence the intended users' decisions (See ISO 14064-3:2006 2.29)

Note 1 to entry: The concept of materiality is used when designing the validation or verification and sampling plans to determine the type of substantive processes used to minimize risk that the validator or verifier will not detect a material discrepancy (detection risk).

Note 2 to entry: The concept of materiality is used to identify information that, if omitted or misstated, would significantly misrepresent a GHG assertion to intended users, thereby influencing their conclusions. Acceptable materiality is determined by the validator, verifier or GHG program based on the agreed level of assurance.

[SOURCE: ISO 14066:2011, 3.4.11]

3.2.2.10

monitoring

continuous or periodic assessment of GHG emissions and GHG removals or other GHG-related data

[SOURCE: IEC TR 62726:2014, 3.18]

3.2.2.11**primary effect**

intended change caused by a project activity in GHG emissions, GHG removals, or storage associated with a GHG source or sink

[SOURCE: IEC TR 62726:2014, 3.20]

3.2.2.12**rebound effect**

Increased use of a solution as a consequence of its lower GHG emissions impact, which partly or fully cancels out the initial GHG emissions savings intended by the solution

[SOURCE: WBCSD, Guidance of avoided emissions:2023]

3.2.2.13**reference function**

set of performance characteristics (including a combination of a conventional products or human activities) having equivalent function with an assessed

[SOURCE: IEC TR 62726:2014, 3.23]

3.2.2.14**reference product**

product with a baseline GHG emissions assessment or adopted to baseline scenario to quantify avoided emissions

[SOURCE: IEC TR 62726:2014, 3.24, modified added “or adopted to baseline scenario to quantify avoided emissions”]

3.2.2.15**secondary effect**

unintended change caused by a project activity in GHG emissions, GHG removals, or storage associated with a GHG source or sink

[SOURCE: IEC TR 62726:2014, 3.25]

3.2.2.16**target product**

product which enables GHG emission reductions or avoided emissions

Note 1 to entry: The target product is different from the assessed product when the target product is an intermediate product (e.g., inverter driver circuit) to be integrated into the assessed product (e.g., an air conditioner) and enable the assessed product to reduce GHG emissions.

[SOURCE: IEC TR 62726:2014, 3.26, modified]

3.2.3 Terms related to life cycle assessment**3.2.3.1****critical review**

576 activity intended to ensure consistency between the CFP study and the principles and
577 requirements of this document

578 Note 1 to entry: Requirements for critical review are described in ISO/TS 14071.

579 [SOURCE: ISO 14067:2018, 3.1.4.10]

580 **3.2.3.2**
581 **cut-off criteria**

582 specification of the amount of material or energy flow or the level of significance of GHG
583 emissions associated with unit processes or the product system to be excluded from a CFP
584 study

585 Note 1 to entry: "Energy flow" is defined in ISO 14040:2006, 3.13.

586 [SOURCE: ISO 14067:2018, 3.1.4.1]

587 **3.2.3.3**
588 **life cycle**

589 consecutive and interlinked stages of a product system, from raw material acquisition or
590 generation from natural resources to final disposal

591 Note 1 to entry: The phrase 'life cycle phase' is sometimes used interchangeably with 'life cycle stage'

592 [SOURCE: ISO 14040:2006, 3.1]

593 **3.2.3.4**
594 **life cycle assessment**
595 **LCA**

596 compilation and evaluation of the inputs, outputs and the potential environmental impacts of a
597 product system throughout its life cycle

598 [SOURCE: ISO 14040:2006, 3.2]

599 **3.2.3.5**
600 **life cycle thinking**
601 **LCT**
602 **life cycle perspective**
603 **LCP**

604 consideration of all relevant environmental aspects of a product during its entire life cycle

605 Note 1 to entry: LCT does not imply undertaking a life cycle assessment.

606 [SOURCE: IEC 62430:2019, 3.2.3]

607 **3.2.3.6**
608 **sensitivity analysis**

609 systematic procedures for estimating the effects of the choices made regarding methods and
610 data on the outcome of a CFP study

611 [SOURCE: ISO 14067:2018, 3.1.4.7]

612 **3.2.3.7**
613 **unit process**

smallest element considered in the life cycle inventory analysis for which input and output data are quantified

[SOURCE: ISO 14067:2018, 3.1.3.6]

3.3 Terms related to organizations and interested parties

3.3.1 organization

person or group of people that has its own functions with responsibilities, authorities and relationships to achieve its objectives

Note 1 to entry: The concept of organization includes, but is not limited to, sole-trader, company, corporation, firm, enterprise, authority, partnership, charity or institution, or part or combination thereof, whether incorporated or not, public or private.

[SOURCE: ISO 14067:2018, 3.1.5.1]

3.3.2 supply chain

those involved, through upstream and downstream linkages, in processes and activities relating to the provision of products to the user

Note 1 to entry: In practice, the expression “interlinked chain” applies from suppliers to those involved in end-of-life processing, which may include vendors, manufacturing facilities, logistics providers, internal distribution centres, distributors, wholesalers and other entities that lead to the end user.

[SOURCE: ISO 14067:2018, 3.1.5.2]

3.3.3 value chain

entire sequence of activities or parties that create or receive value through the provision of a product

[SOURCE: IEC 62430:2019, 3.3]

3.4 Terms related to verification and validation

3.4.1 validation

a systematic, independent, and documented process for the evaluation and GHG assertion into a GHG project plan against agreed criteria

[SOURCE: IEC TR 62726:2014, 3.28]

3.4.2 verification

a systematic, independent, and documented process for the evaluation of a GHG assertion against agreed validation criteria

[SOURCE: IEC TR 62726:2014, 3.29]

3.5 Abbreviated Terms

CFP carbon footprint of a product

652	CFP-PCR	carbon footprint of a product – product category rules
653	CO ₂ e	carbon dioxide equivalent
654	EE	electronics and electric
655	GHG	greenhouse gas
656	GHG SSRs	greenhouse gas sources, sinks and reservoirs
657	GWP	global warming potential
658	HFCs	hydrofluorocarbons
659	ICT	Information and Communication Technology
660	IPCC	Intergovernmental Panel on Climate Change
661	IT	Information Technology
662	LCA	life cycle assessment
663	LCP	life cycle perspective
664	LCT	life cycle thinking
665	PFCs	perfluorinated compounds or perfluoro compounds
666	PCR	product category rule
667	PSR	product specific rule
668	RSL	reference service life
669	SF ₆	sulfur hexafluoride or sulphur hexafluoride

670 **4 Principles**

671 **4.1 General**

672 The application of the following principles is fundamental to quantify, document and report GHG
673 emissions related to EE product(s) under assessment.

674 **4.2 Life Cycle Thinking (LCT)**

675 In the development of methodology to quantify the GHG emissions throughout EE product's life,
676 the product or systems manufacturer includes all stages of the life cycle of a product into
677 consideration.

678 **4.3 Relevance**

679 The manufacturer of the product or the system uses an analysis, such as sensitivity and/or
680 materiality, which enables demonstration of how the requirements can be determined. These
681 requirements are not limited to those defined in the following sub-clauses or ISO 14067.

682 **4.4 Completeness**

683 The manufacturer of the product or the system includes all GHG emissions and GHG removals
684 that provide a significant contribution to the assessment of GHG emissions and GHG removals
685 arising from the product, service or system under study.

686 Cut-off criteria specifies the level of significance. The level of significance is justified by a
687 sensitivity analysis.

688 **4.5 Consistency**

689 The manufacturer of the product or the system applies assumptions, methods and data in the same way
690 throughout the quantification of GHG emissions for EE product's life cycle to achieve conclusions in
691 accordance with the scope of this document.

692 **4.6 Accuracy**

693 The manufacturer of the product or the system reduces bias and uncertainties and avoid
694 misleading as far as is practical. This includes ensuring the quantification of GHG emissions is
695 systematically neither over nor under actual emissions, as far as can be judged and that
696 uncertainties are reduced as far as practicable. Achieve sufficient accuracy to enable users to
697 make decisions with reasonable assurance as to the integrity of the reported information.

698 **4.7 Transparency**

699 The manufacturer of the product or the system addresses all documentation along with the
700 relevant issues in an understandable, open, and comprehensive presentation of information.
701 This includes fully disclosing any relevant assumptions and limitations and make appropriate
702 references to the methodologies and data sources used. Information clearly explain any
703 estimates and avoid bias so that the GHG emissions throughout the EE product's life cycle
704 study report faithfully represents what it purports to represent.

705 **4.8 Conservativeness**

706 The manufacturer of the product or the system uses conservative assumptions information and
707 values with procedures to ensure that GHG emission reductions, GHG removal enhancements,
708 or avoided emission are not over-estimated.

709 **4.9 Priority of scientific approach**

710 The manufacturer of the product or the system gives preference to natural science such as
711 physics, chemistry, and biology when making decisions related to study of CFP, GHG emission
712 reductions, or avoided emissions. If this is not possible, other scientific approaches such as
713 social and economic sciences or approaches contained in relevant international conventions
714 and valid within the geographical scope as defined to be used. Data scientific approach is also
715 recommended. Decisions based on value choices are only be permitted if:

- 716 – A natural scientific basis does not exist; or
- 717 – A justification based on other scientific approaches or international conventions is not
718 possible

719 **4.10 Avoidance of double counting**

720 The manufacturer of the product or the system ensures that double counting of GHG emissions
721 and GHG removals within the studied product system in the organization is avoided when the
722 allocation of the same GHG emissions and GHG removals occurs only once.

723 Direct GHG emissions, energy indirect GHG emissions and other indirect GHG emissions are
724 mutually exclusive for the reporting company, such that there is no double counting of emissions
725 between the scopes.

5 Strategy

5.1 General

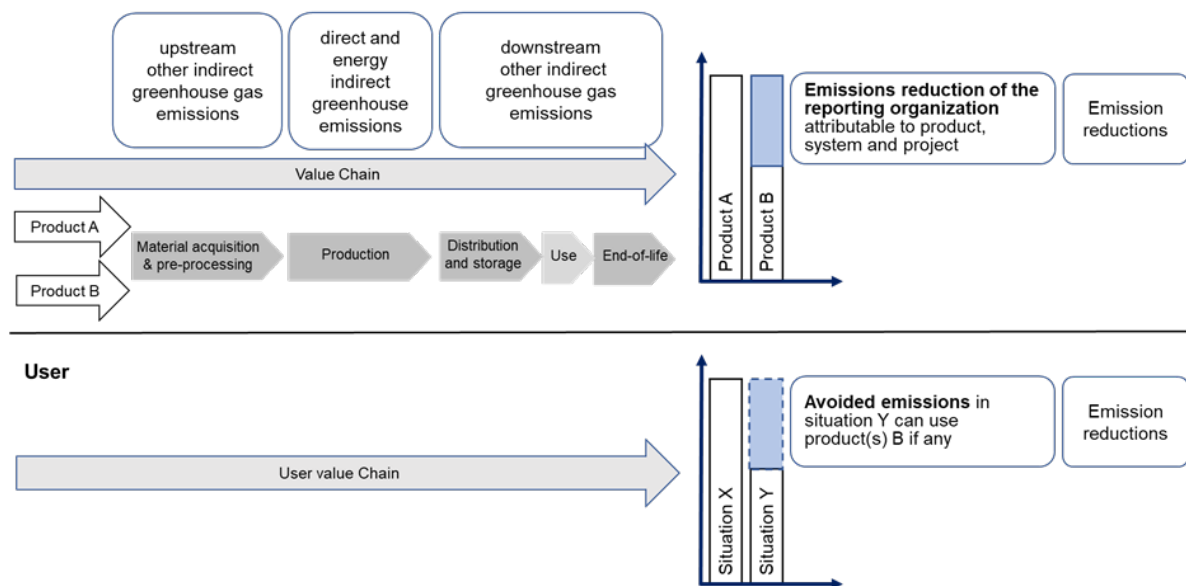
Towards net-zero carbon emissions, any organizations need to reduce GHG emissions. Therefore, when an organization replaces a current product or system with the alternative or introduces a new product or system, it needs to know how much the alternative/new product or system can reduce or increase GHG emissions in order to understand the impact of its product. In the case of an increase, it needs to know how much emissions can be suppressed by the alternative or new one rather than using current product or system to lower the increase as much as possible.

Providers of EE product and system are expected to commit the efforts for developing innovative solution to achieve low-carbon or non-fossil energy use products and systems to meet market needs. These products and systems are expected to quantify GHG emissions and removals based on CFP methodology on a life cycle basis, and to provide necessary information to contribute GHG emissions reduction within the value chain of EE product providers. In addition, the products and systems could be performed as enabling products or systems to reduce GHG in the user's value chain. Therefore, providers of products and systems make the information of avoided emissions available for the users and the market to be selected and used the product or the systems. Through the information sharing of avoided emissions, the providers aim to reduce or curb GHG emissions outside of their organization. This information would then be used by investors, analysts, and potential users of new products and systems to understand the options to reduce GHG emissions and be successful under different reduction scenarios.

The GHG quantification methodology described in this standard recognizes “Avoided Emission” as a special type of “Emission Reduction”. More precisely: “Avoided Emissions” are the difference between emissions of a baseline system of product and emissions of a targeted system of products intended to achieve the same results. As explained in the previously, avoided emissions reports are intended for users and markets in order to make informed choices regarding GHG emissions in their scope of control.

5.2 View and pathway to low carbon society

It is important that the organization plans how it can reduce GHG emissions from the products or systems throughout the value chain of EE products and systems and execute the plan.

Reporting Organization**Figure 1 – GHG emission reductions and avoided emissions**

A systematic planning method toward a low carbon value chain shall take into account all steps in the value chain as illustrated in Figure 1. For each step in the value chain, the GHG emissions caused by a current product (Product A, also known as baseline) shall be assessed, and the same shall be done for an alternative product (product B, also known as alternative).

In this framework, GHG emissions reduction is assessed as quantified decrease attributed to the product or the system comparing the baseline within a reporting organization's value chain. Furthermore, avoided emissions are quantifiable consequence to a situation (Situation Y) within use of its alternative products or systems compared to a baseline scenario (Situation X) that is expected to happen in the user's value chain.

NOTE 1: This assessment can also be done for services, or even for systems of products and services.

NOTE 2: More than one alternative may be compared with the baseline.

A systematic pathway to a low carbon society implies:

- the GHG quantifications for the baseline and the alternative are done
- results are compared before the decision to implement an alternative as possible replacement for the baseline,
- consideration of avoided emissions shared by other organization, and
- priority is given to the alternative with lower GHG emissions than the baseline.

Avoided emissions can be realized by using an environmentally conscious product or system with advanced technology with a special focus on GHG emission reductions under the same conditions. They play important role in transition period to low carbon society and decarbonization and in its maintenance and improvement because CO₂ emissions can be reduced in another organization's value chain by the avoided emissions brought by the sphere of influence of the EE product or system in its use phase. Avoided emissions are not only obtained by a gap between two technologies but also by the direct use of a product. Products or systems for energy management systems such as building automation systems or distributed energy management systems (Electrical utilities) avoid emissions by their functions.

5.3 Strategy for application to system

Life cycles vary according to the nature, purpose, use and prevailing circumstances of the system (relation to “life cycle stage” could be as represented in Figure 2). Despite an apparently limitless variety in system life cycles, there is an underlying, essential set of characteristic life cycle stages that exists in the complete life cycle of any system. Each stage has a distinct purpose and contribution to the whole life cycle which could be summarized as shown in Figure 2.

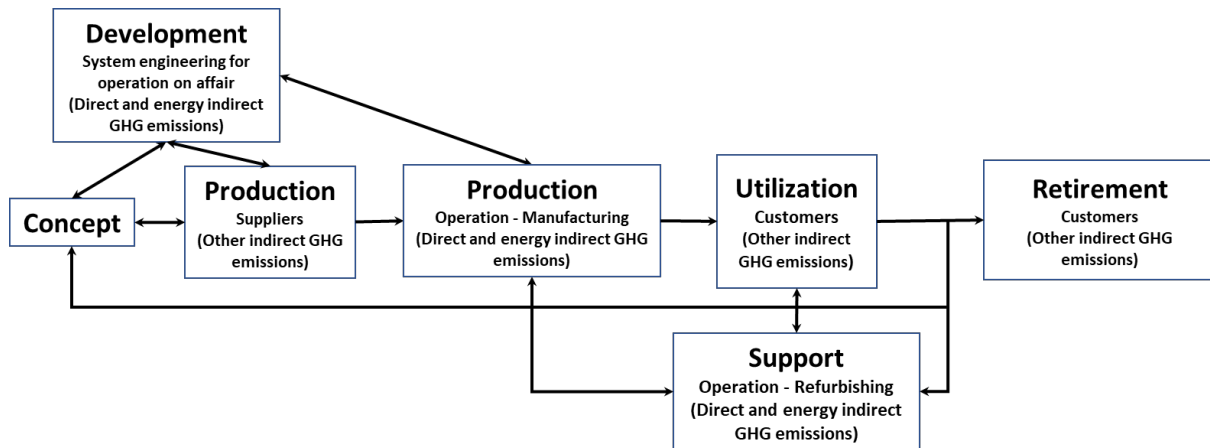


Figure 2 – Life cycle model with some of the possible progressions (ISO/IEC 24748-1 Figure 6)

The strategy to achieve low carbon systems is to systematically assess the GHG emissions for all system elements in all lifecycle stages as shown in Figure 2. The stages; development (design), production (manufacturing), utilization (use), support (maintenance), and retirement (disposal) are practically interdependent. Stages do not necessarily occur one after another in time sequence. For example, if one stage should be started before a “preceding” stage is completed, the stage being started should have its own entrance criteria separate from the exit criteria of the “preceding” stage. This justifies the need of criteria between stages and double arrows as shown in Figure 2. This assessment shall be done for both the baseline system and the alternative system(s), i.e., for a system (or systems) using one or more alternative products and/or services intended to reduce GHG emissions. The assessment shall be done before the choice for an alternative and in this choice the achievement of GHG emission reduction shall have priority.

6 Quantification

6.1 Carbon footprint of Product (CFP-PCR)

6.1.1 General

This sub-clause specifies the quantification requirements of CFP for the EE sector.

For LCA and methodology for CFP quantification, IEC 63366 and ISO 14067 shall be used.

Where it is necessary to develop a PCR or PSR for a specific product or a specific system, this clause shall be referred to ensure consistency throughout the EE sector.

The goal of carrying out CFP study on EE products and systems shall quantify the contribution of a product to global warming expressed in CO₂e by quantifying the GHG emissions and GHG removals, over its life cycle.

A workable and simple way to conduct CFP study for EE products and systems based on the LCA and CFP standards and initiatives shall follow the following 9 steps:

- Step 1: Define the goals and scope of CFP quantification
- Step 2: Determining functional or declared unit
- Step 3: Determining the system boundary of the product or the system
- Step 4: Trial estimation and decision on boundary to be cut-off
- Step 5: Data collection and quality assessment
- Step 6: Development of scenario
- Step 7: Calculation of GHG emissions
- Step 8: Impact assessment for CFP or partial CFP
- Step 9: Interpretation (Uncertainty assessment) for CFP or partial CFP

The CFP consists of the GHG emissions and GHG removals in the life cycle of a product (i.e., product system). The unit processes comprising the product system are grouped into life cycle stages; e.g., raw material production, transformation and acquisition, production, distribution, use and end-of-life for the product system. Accordingly, the data of GHG emissions and GHG removals collected over the product's life cycle are assigned to the life cycle stages. Partial CFP studies accounting for specific life cycle stages can be combined to form the full CFP covering the entire life cycle as long as they are performed according to the same methodology and the time frame for relevant activities is viewed as equivalent.

Results of CFP study based on LCA performed for a reference product can be extrapolated to other products, provided that these products belong to a same homogeneous product family as the reference product.

To belong to a homogeneous product family, the group of products shall have all the following characteristics:

- Same main function,
- Same product standards, and
- Similar manufacturing technology: same type of materials and manufacturing processes.

If the environmental data, material balance or environmental impacts differ from those of the reference product, extrapolation rule(s) allowing the data to be estimated at every stage of the life cycle shall be used. If extrapolation rules are already set in the product specific rule (PSR), where they are set based on LCA for different products, justified and documented in the PSR, the existing extrapolation rules shall be applied. If no extrapolation rules are set in the PSR, new rules shall be defined as described in 6.1.12.

6.1.2 Goal and scope definition of quantification of CFP

To start CFP study on an EE product or system, goal and scope shall be set. In defining the goal of CFP study on an EE product or system, the following items shall be specified:

- the intended application,
- the purpose of carrying out the quantification results, and
- the intended audience.

Examples of the goal of the study can include but are not limited to:

- Illustrate performance of the product in terms of GHG emissions for decision making
- Provide CFP results to the customer upon request

- Include CFP results into the product declaration on the web page disclosed to the public

In defining the scope of GHG emissions from an EE product or system, the following items shall be considered and specified:

- a) the product or system under the quantification and its functions,
- b) the functional or declared unit (see IEC 63366 CDV and ISO 14067),
- c) the system boundary, including the geographical scope of the system under study (see IEC 63366 CDV, ISO 14067)
- d) data including time boundary and data quality requirements (see IEC 63366 CDV, ISO 14067 and as shown in 6.1.6),
- e) assumption, development of scenario (as shown in 6.1.7),
- f) allocation (see IEC 63366 CDV and as shown in 6.1.8),
- g) calculating GHG emissions (incl. specific GHG emissions and GHG removals, if applicable (see ISO 14067 and as shown in 6.1.9),
- h) impact assessment (see ISO 14067 and as shown in 6.1.10),
- i) interpretation (see ISO 14067 and as shown in 6.1.11),
- j) the report of CFP study (see ISO 14067 and as shown in 6.5),
- k) the type of critical review (see ISO 14067), if any, and
- l) limitations of the CFP study (see ISO 14067:2018 Annex A).

In accordance with IEC 63366 CDV and ISO 14067, the organization shall identify the considerations described below. In addition, provisions in the Greenhouse Gas Protocol Product Life Cycle Accounting and Reporting Standard to identify the important considerations regarding the choice of the studied product.

When determining which product to study, the organization shall take into account the following key relevant considerations:

- Design or progress of technology
- Product function and characteristics
- User, use/service conditions and site infrastructure
- Normal duration of use/service time
- Consumables, other supportive products and maintenance requirements
- Scheme of end of life

NOTE: Additional key relevant considerations should be defined by the organization.

Users of this standard shall evaluate and define applicable additional key considerations.

Grouping of a product series or product family where the impact of GHG emissions can reasonably be expected to be similar, based on similar function or technology, should be recognized as one product category. In that case, a CFP study should be implemented for the group of product series as one product category.

6.1.3 Functional or declared unit

The functional unit or declared unit shall be defined by:

- a) the main function(s) delivered to the user;

b) the magnitude and level of performance to be achieved for the main function(s). This level shall be quantified and determined according to the market habits, regulatory requirements, standards and/or the technical state of the art;

c) the reference service life (RSL) for the reference product, corresponding to the stipulations set out in ii).

The functional unit is used as a reference unit to allow comparison between different alternatives (e.g., products, systems or technical solutions) intended to provide the main functions with the required level of performance.

NOTE 1 Some products or systems may have complex functional unit descriptions, for example multifunctional products such as smartphones.

The declared unit can only be used in a partial CFP.

Having chosen the functional or declared unit, the associated reference flow shall be defined.

The unit of analysis is defined as the reference flow for intermediate products where the eventual function is unknown. For many EE products, the functional unit can be too complicated to simply identify. For example, a highly customized TV set can have a number of various of functional units that cannot be uniformly defined. In this case, "product unit" is applicable to the EE products that perform multiple or complex functions, whether it is a final product or an intermediate product (e.g., one laptop computer, one LED luminaire, one functional semiconductor device, etc.).

6.1.3.1 Examples of defining functional unit and reference flow

The following functional units can be applied during manufacturing processes and functional unit life:

- Performance index (indicator) with the function of a product
 - Rated value (volume, weight, size, processing speed, memory capacity, hard disc capacity, etc.)
- Condition of the utility duration
 - Normal duration of use/service time (per hour, day), and lifetime and associated environmental and operating conditions

Functional units of product, system or service should be described through many functional requirements related to CO₂eq quantification.

6.1.3.2 Examples of functional requirements defining functional unit(s)

A LCA functional Unit should exist and cover the functional requirements of the users of products, systems and services. Then the respective CO₂ footprint of the physical elements and processes from the reference flows should be considered when building or infrastructure assess their CO₂eq. Below some examples which are not limited to building and infrastructure areas. Several user's functional requirements are given as examples as follows

Products:

ICT product:

- a) processing speed,
- b) memory capacity,
- c) hard disc capacity,
- d) etc.

Power products: See IEC 63366 CDV

- a) Motor: To provide (50 kW) of (mechanical power), over (20) years RSL with (260) days of operation per year and (16) operating hours per day.
- b) Cables (Energy distribution networks in the area of infrastructures): To transmit energy expressed for 1A over a distance of 1 km for 40 years and a 100 % use rate in accordance with relevant standards (mention the relevant standards or refer the product technical data sheet).
- c) Circuit breaker: To carry its rated current, without interruption for a period of 20 years, to make and break its rated current for a defined number 3000 cycles, to interrupt an overload current at a specific multiple (N) of the rated current for a defined number (M) times, where multiples N and M are defined in IEC 60947-2, to break and make a short-circuit up to its rated ultimate short-circuit breaking capacity (Icu) and its rated service short-circuit breaking capacity (Ics), in accordance with IEC 60947-2. breaking capacity.
- d) Power transformers (reuse the current we have in the CD2)
- e) Durability is defined in accordance with the reference service life, under specified conditions;
- f) Avoid the use of GHG gas
- g) Amount of avoided CO₂eq by secondary material flows:
 - a. % recycled material content,
 - b. % recyclability rate

Systems

Power Systems :

- a) Specified user functional requirements related to the grid energy management
 - a. Electrical needs justifying a new architecture
 - b. Single line diagram based on architecture justifying the design of the switching device, assemblies and power systems
 - c. Energy management
 - i. Energy consumption
 - 1. Maximum specification of the CO₂eq amount (kgCO₂eq/kwh)
 - 2. Specified carbon emission intensity
 - a. Location
 - b. Activity
 - ii. Flexibility management
 - 1. Control system aggregating demands
 - 2. Control system balancing demand and response with storage, based on external signal and if any linked to multicriteria (grid stability, price, CO₂eq, etc)
 - 3. Control system managing several sources of generation
 - iii. Integrate a minimum of % renewable energy generation
 - iv. Demonstrate an energy saving by X%
 - v. Reference service life (RS) under specified conditions,
 - 1. Durability of equipment
 - 2. Specified conditions
 - vi. Time to recover operation (s)
 - vii. Specified electrical grid distribution indexes :
 - 1. SAIDI: System Average Interruption Duration Index
 - 2. SAIFI: System Average Interruption Frequency Index